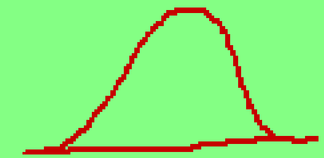
AP STAT: Section 1.3

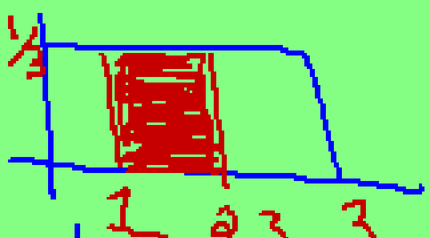
Other Distributions (using mean and std. deviation)

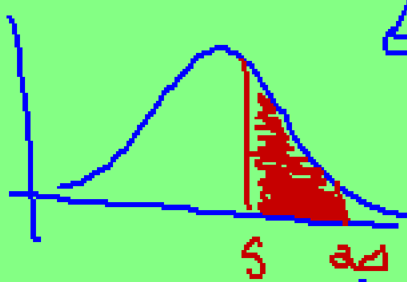


Histogram/stemplot/etc.

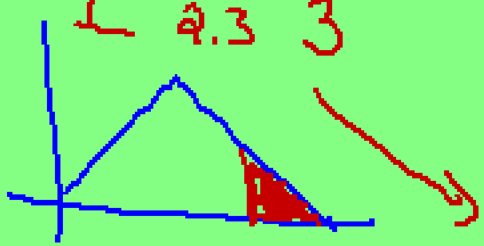
- Sample of data
- actual observations
- diff. forms
  - hist. -dot
  - stem -bar
  - box

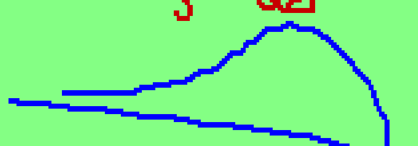
Use $\bar{x}$ and S





$\int_5^{20}$





$A = (1.3)(1/3) = 0.4333$

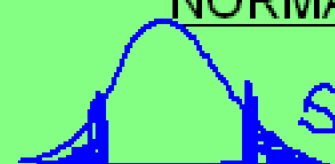
$N(75, 4)$

Density Curve

- smooth curve - continuous distr
- population use: μ and σ
- idealized model of the data
- one form → diff. shapes
- *area under curve = 1 = 100%
  - like rel. freq. hist.

Specific Density Curve:

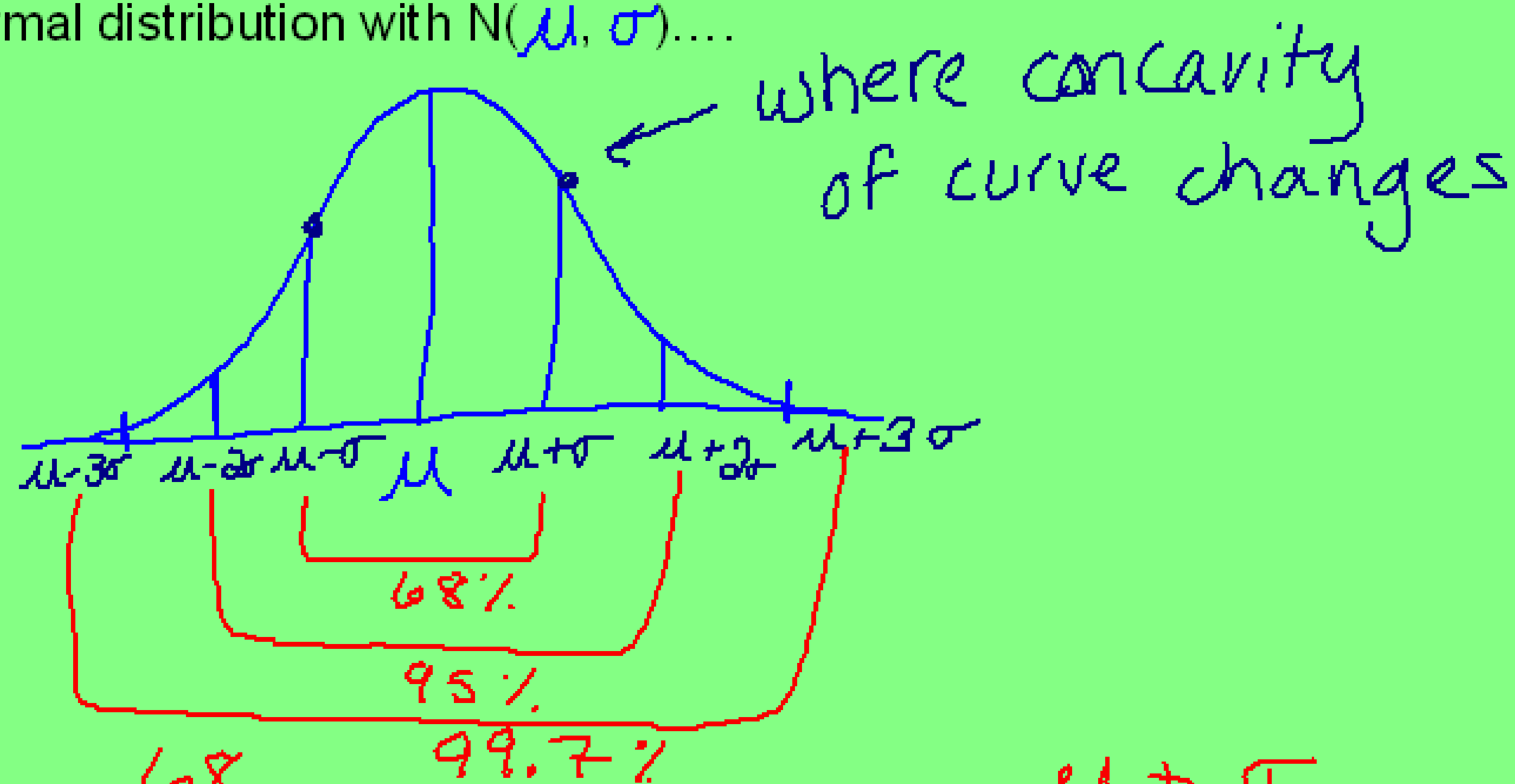
NORMAL CURVE (or DISTRIBUTION)



- symm, unimodal, bell-shaped
- describe normal data:
  - Ex: hts, wts, test scores
- $N(\mu, \sigma)$

Empirical Rule

In a normal distribution with N(μ, σ)....



- 68 % of the observations fall within $\mu \pm \sigma$
- 95 % of the observations fall within $\mu \pm 2\sigma$
- 99.7 % of the observations fall within $\mu \pm 3\sigma$

Example:

The avg. time that it takes a crew from Sweeper Sam to clean a room is normally distributed with a mean of 2.1 hrs and a standard deviation of 0.3 hrs.

$\pm 2\sigma$

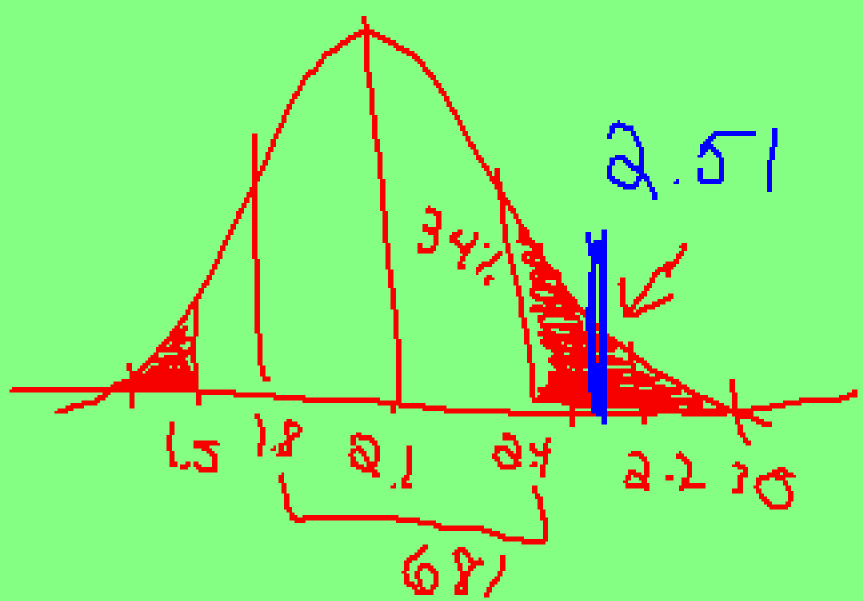
a) The total clean up time will fall within what interval 95% of the time?

$N(2.1, 0.3)$ $\quad \mu \pm 2\sigma = 2.1 \pm 2(0.3) = (1.5, 2.7)$ hrs

b) What proportion of the time will it take the crew 2.5 hours or more?

16%

c) What percent of the time will it take the crew 1.5 hrs or less?



Standardizing Observations

1) You are in a history class and a math class. You take your chapter 1 test in both classes on the same day, and get them both back a few days later. Your grades are as follows. Which class did you do better in?

History: 81% *Math: 75%*

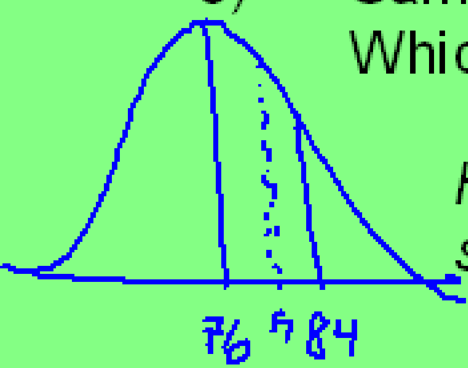
2) Same scenario. However, each teacher tells you a bit about how your class did. Which class did you do better in?

same

History:
mean: 76%

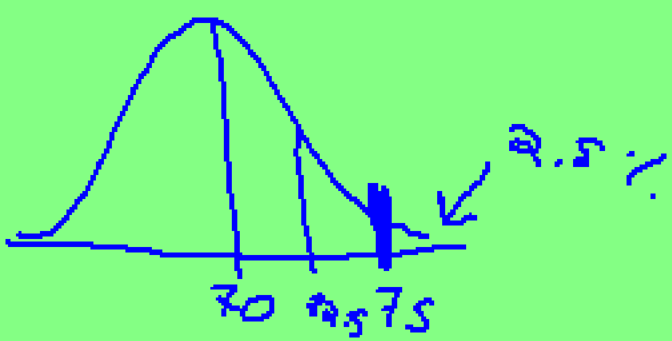
Math:
mean:70%

3) Same scenario. However how your teacher gives you the class standard deviations. Which class did you do better in?



History:
std. dev: 8%

Math:
std. dev:2.5%



0.7σ $<1\sigma$

2σ

Standardizing Observations

Question: *How can we compare one distribution to another distribution if they don't have the same parameters (mean and std. dev)?*

Answer: compare the observation to its mean and std. dev.

To standardize:

- *measure observations….* in terms of how far it is above/below its μ.
- Z = Z-score = $\dfrac{x - \mu}{\sigma}$ obs.
- *Z- score tells us…* how many σ that obs. is above/below its μ

Z = 1.3 = the obs. is 1.3σ above its μ.

-2.1

Example: *The heights of 18-24 year old women are normally distributed with the following:*

mean = 64.5" *and* *std. dev = 2.5"* $N(64.5, 2.5)$

We know a woman who is 69" tall. How does she compare to the rest of the women in her age group? Calculate her z score, and interpret what it means.

$$z = \frac{x-\mu}{\sigma} = \frac{69-64.5}{2.5} = 1.8$$

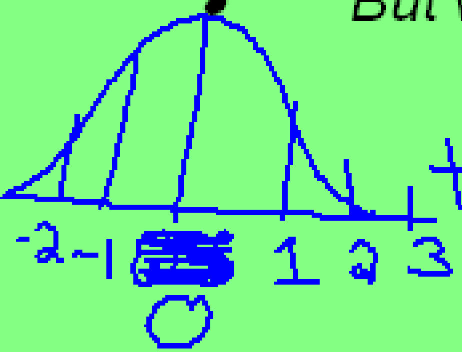
1.8σ above her μ

Man: 69" tall $N(67, 2.1)$

$$z = \frac{69-67}{2.1} = 0.95$$

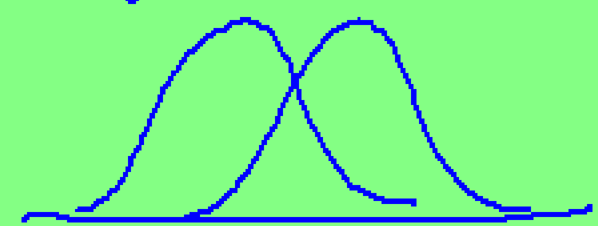
Notes on Standardizing a distribution:

- Standardizing one observation… compare it to its mean
- But we can also standardize… a whole distribution by comparing the whole distr. to its mean & std. dev.



$$z = \frac{x - \mu}{\sigma}$$

- But what does this do to the shape of the distribution?



doesn't change

- Standardizing is actually just…

– changing the units

– manipulating the data

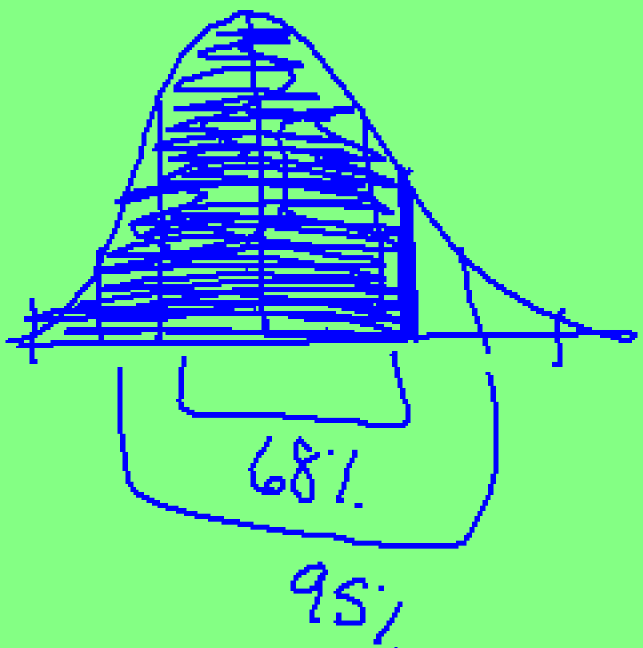
- When we do this we have a new distribution, called: Standard Normal Distrib.

T-2 and T-3

- Table A in the book
  - Gives: prob. (%, prop, area) of data below a certain z-score
  - So, the area to the left of the z-score represents…

$z = 1.3$

% of the data below = percentile



$z = 1.34$

Back to the height example….

Remember that the heights of 18-24 year old women are N(64.5", 2.5"). What percentile is the girl who is 68" tall?

$N(64.5, 2.5)$

$z = \frac{68-64.5}{2.5} = 1.4$

$P(x < 68") = 0.9192 = 91.92\%$

What percent of 18-24 year old women are less than 5 feet tall?

$P(x < 60") = 0.0359 = 3.59\%$

$z = \frac{60-64.5}{2.5} = -1.8$

What percent 18-24 year old of women are over 5'8" tall?

$P(x > 68")$ $\quad 1-0.9192 = 0.0808$

8.08%

$z = 1.4$

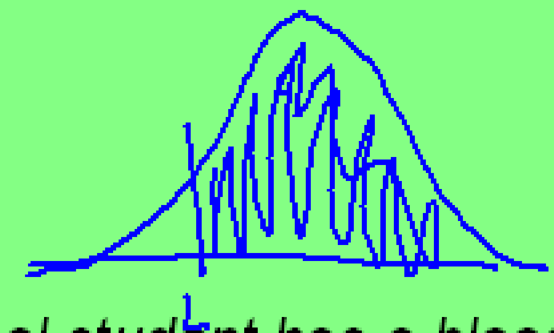
$P(62 < x < 67) = 0.6826$

**** PROBABILITY NOTATION!!** $P(X \geq \_\_\_\_) = \text{answer}$

Another example:

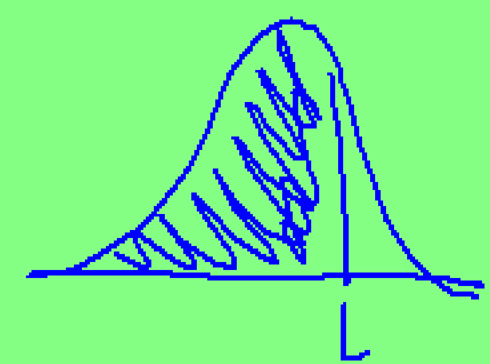
Blood pressures of high school students are N(170, 30). What is the probability that a randomly selected high school student has a blood pressure of 180 or above?

$$P(X > 180) = 0.3694$$

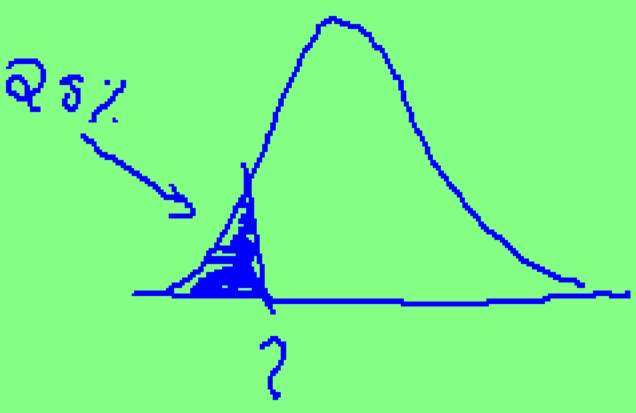


Using the same data as above, what is the probability that a high school student has a blood pressure between 160 and 230?

$$P(160 < X < 230) = 0.6078$$



Using the same data as above, what blood pressure has 25% of the bobservations below it?



$$P(X < L) = 0.25$$

$$L = 149.765$$

Obs. that has 72% data above it?

Calculator use:

To find the percent of observations between 2 points:

$P(\_\_ < x < \_\_)$

normalcdf(lowerbound, upper bound, μ, σ)

To find what observation has a certain percent of the data <u>below</u> it:

$P(x < L) = \%$

invnorm(proportion below obs., μ, σ)

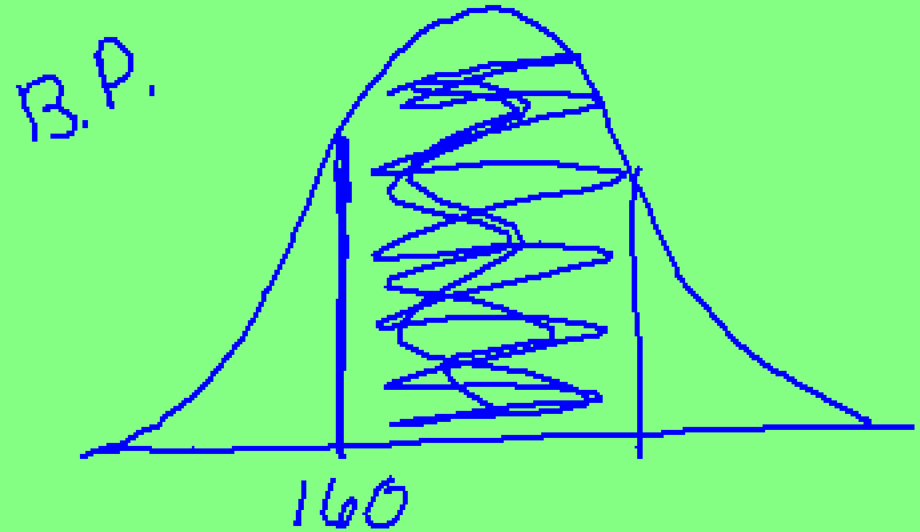
decimal

On the calculator, infinity is:

$E99 = \infty$

$-E99 = -\infty$

$P(160 \le X \le 230)$



a) $P(X < 175)$

b) $P(X \le 175)$

continuous

* $P(X = 160) = 0$

$$\int_{160}^{230} f(x) = 0$$